

**Commonwealth of Kentucky**  
**Division for Air Quality**  
***PERMIT STATEMENT OF BASIS***

(DRAFT)

Title V / Synthetic Minor, Operating

Permit: V-07-009

Air Products and Chemicals, Inc.

Calvert City, KY 42029

June 8, 2007

Carolina Alonso, Reviewer

SOURCE ID: 21-157-00009

SOURCE A.I. #: 2915

ACTIVITY ID: APE20070001

**SOURCE DESCRIPTION:**

Air Products and Chemicals, Inc. (Air Products), Calvert City, is a chemical manufacturing plant. The source is a major source, as defined by 401 KAR 52:020 Title V Permits, for the potential emissions of over 100 tons per year of nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), and volatile organic compounds (VOC), the potential of a single hazardous air pollutant (HAP) greater than 10 tons per year, and the potential combined HAP emissions greater than 25 tons per year.

The source is also a major source, as defined by 401 KAR 51:017 Prevention of Significant Deterioration of Air Quality (PSD), for potential emissions of over 100 tons per year of NO<sub>x</sub>, CO, and VOC.

Title V permit V-07-009 incorporates the conditions of previous permits and information in applications received after the Title V application. The original Title V application was received on December 10, 1998, and it was updated through five submittals, which were received between May and September 2005. A new updated Title V permit application (combining previous submittals) was received on February 28, 2007.

For the purpose of Title V permitting, this facility is split into the following areas:

1. Vinyl Acetate Monomer (VAM) Storage
2. Acetylenics (Specialty Additives) Production Unit
3. Air Products Polymers (APP) Emulsions Production Unit
4. Plant Utilities
5. Cogeneration Plant

**1. Vinyl Acetate Monomer (VAM) Storage:**

Vinyl acetate monomer (VAM) is a raw material for both the APP Emulsions plant and the Celanese Polyvinyl alcohol (PVOH) plant. VAM is shipped from the Texas Gulf Coast via barge. VAM barges are unloaded at a station on the Tennessee River into either of two VAM storage tanks (FB-1515 & 1516) at the river. VAM is pumped from the river to either of two VAM day storage tanks (FB-1510 & 1510) on the main plant site. The VAM day storage tanks supply raw material to both APP Emulsions and Celanese PVOH via dedicated pipelines to each plant.

Fugitive equipment leaks from VAM piping from the barge unloading, to the tanks, and on to the APP Emulsions plant are accounted for in the Emulsions section of this permit application.

## **2. Acetylenics (Specialty Additives) Production Unit:**

The Acetylenics production unit produces surfactants, corrosion inhibitors, and chemical intermediates. The Acetylenics process is a combination of continuous and batch processes. The reaction (RXN) process including solvent recovery is continuous. The Distillation and Blending (BL-DR-TKFM) processes are batch. The potassium hydroxide (KOH) concentration process (KOH CONCEN) is batch while the KOH/Diisopropyl ether (IPE) slurry preparation is continuous.

In the reaction area, acetylene and ketone are fed to reactors with a KOH/IPE slurry feed. The resulting crude reaction mass is hydrolyzed with water forming two distinct process layers. The organic layer is best described as an acetylenic semi-crude intermediate. The water layer contains about 20% KOH in water solution.

The acetylenic semi-crude layer is further processed to remove any residual caustic and eventually is fed to a continuous IPE solvent recovery distillation column. Recovered IPE solvent is stored to make more KOH/IPE slurry for reaction.

The KOH water layer is fed to a pre-heater and then to a KOH evaporator where the KOH concentration is raised from ~20% to 55% KOH. 55% KOH solution is stored in tanks for further processing.

In the (KOH CONCEN) area, 55% KOH solution is batch fed to concentration pots. Heating the pots and pulling vacuum raises the concentration to 85-90%. Concentrated KOH is then fed to a flaking operation where molten KOH is frozen on a cooled drum and fed as a solid to the mix tank. IPE is added to the mix tank to make the KOH/IPE slurry. The slurry is processed through grinding loops to reduce the KOH particle size. Once prepared, KOH/IPE slurry is fed to reaction at the beginning of the process.

After reaction, there are several continuous processing steps to separate the Acetylenics Products from the water phase and other organics. One continuous step separates the Acetylenics Semi-crude from the other organics with the Semi-crude accumulated for subsequent batch distillation. There is another continuous distillation to recover IPE with mixed organic solvent containing Acetylenics (MOSCA) that is accumulated for batch distillation. Rundown and storage tanks in the plant collect these materials for a recycle to reaction, use as final product, or waste.

Final acetylenic product is stored before being packaged in bulk, drums, or pails. Final product is also used in a number of blended products for specific customer applications. Final product and other raw materials are batch-fed to a processing tank per recipe specifications. Final blended products are shipped bulk, in drums, or in pails.

## **3. Air Products Polymers (APP) Emulsions Production Unit:**

The Emulsions plant produces over twenty different homopolymer, copolymer, and terpolymers emulsions in any one of six batch reactors (ATM, AF#1, AF#2, AF#3, AF#4, and

AF#5). Ethylene, vinyl acetate, and vinyl chloride monomers are converted to polymer via means of a free radical mechanism. Functional monomers induce cross-linking during polymerization to provide specific properties for the different products. Colloids and surfactants are added to control stability, viscosity, and particle size distribution. Post-additions reduce the residual monomer levels and/or act as biocides and defoamers.

All vinyl chloride monomer (VCM) is reacted in the Airflex #3 reactor, which is vented to two incinerators listed in the Utilities section. The Airflex #4 and #5 reactors always vent to the Airflex #4 flare. The Airflex #1 and #2 reactors are also primarily vented to this flare. The Atmospheric Reactor system has no pollution control equipment associated with it.

In addition to the subunits for each reactor, the Emulsions Plant is divided in the subunits for General associated equipment (including miscellaneous storage and the ethylene tank car flare) and the Tank Farm, used primarily for storage of emulsion product.

#### **4. Plant Utilities:**

The Utilities section consists of the main plant steam and condensate system, influent river water treatment system, VCM incinerators, cooling towers, fire protection systems, and the wastewater treatment (WWT) plant including the dissolved air flotation (DAF) unit.

#### **5. Cogeneration Plant:**

Air Products operates a Cogeneration “Support Facility” to provide steam, electricity, and operating air to the adjacent chemical plant. The Cogen facility consists includes a rental boiler, a gas turbine, and two heat recovery steam generators (HRSGs).

#### **COMMENTS:**

The following table reflects the source-wide emission rate for IPE and Methyl Isobutyl Ketone (MIBK) that shall not be exceeded pursuant to permit S-96-132 (Revised). The table also reflects source wide potential emissions for these pollutants based on the most up-to-date TV application:

<b>Pollutant</b>	<b>Emission Rate</b>	<b>Potential Emissions</b>
IPE	195.19 lb/hr (8-hr average)	53.42 lb/hr
MIBK	78.51 lb/hr (8-hr average)	1.82 lb/hr

Since potential emissions for these pollutants are much lower than the limits established in permit S-96-132 (Revised), these limits are not included in the permit.

#### **Type of control and efficiency:**

Operation of the following control devices will significantly reduce CO, NO<sub>x</sub>, VOC and HAP emissions:

- Ethylene Flare (BA-7501) – 98% efficiency
- AF#4 Air-Assisted Flare (B-94) – 98% efficiency
- North VCM Thermal Oxidizer with Packed Bed Scrubber (EP B-27) – 50% efficiency for CO and

- NO<sub>x</sub>, 98% efficiency for HCl, 99.99% efficiency for VOC
- South VCM Thermal Oxidizer with Packed Bed Scrubber (EP B-39) – 50% efficiency for CO and NO<sub>x</sub>, 98% efficiency for HCl, 99.99% efficiency for VOC
- Low NO<sub>x</sub> burners for the Rental Boiler and the Heat Recovery Steam Generators

Emission factors and their source:

Emission factors are based on AP-42 factors, Tanks 4.0 software, and engineering calculations including mass balances and a source's software (Plantware).

Applicable regulations:

The following regulations apply to Air Products:

401 KAR 51:160, NO<sub>x</sub> requirements for large utility and industrial boilers

401 KAR 59:010, New Process Operations commenced on or after July 2, 1975

401 KAR 59:015, New Indirect Heat Exchangers

401 KAR 63:010, Fugitive Emissions

401 KAR 63:015, Flares

401 KAR 63:020, Potentially Hazardous Matter and Toxic Substances, applies source wide. Air Products submitted on April 2, 2007, an air dispersion modeling analysis and risk assessment for the following pollutants: Vinyl Acetate Monomer (VAM); Methyl Isobutyl Ketone (MIBK); Methanol (MeOH); Isopropyl Ether (IPE); and Acetaldehyde. The Air Toxics Section reviewed this submittal and accepted it as compliance demonstration with 401 KAR 63:020. The Division may request modeling for other air toxics and/or hazardous air pollutants emitted by the source at any time.

40 CFR 60 Subpart Db, Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units

40 CFR Part 60 Subpart Dc, Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

40 CFR 60 Subpart Kb, Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984

40 CFR 60 Subpart GG, Standards of Performance for Stationary Gas Turbines

40 CFR 61 Subpart F, National Emission Standard for Vinyl Chloride

40 CFR Part 63 Subpart FFFF, National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing

40 CFR 63 Subpart YYYYY, National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines. However, existing affected sources (i.e.: commenced before January 14, 2003) do not have to comply with any requirements from this subpart.

40 CFR 63 Subpart DDDDD, National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters

SECTION K of permit V-07-009 contains NO<sub>x</sub> Budget requirements

**EMISSION AND OPERATING CAPS DESCRIPTION:**

In order to preclude applicability of 401 KAR 51:017, Prevention of Significant Deterioration of Air Quality (PSD), the source has elected to accept the following limits:

Area	Limit Description	Pollutant
Emulsions (group limit)	Emissions shall not exceed 42.7 tons per year, based on a 12-month rolling average*	VOC

\* Synthetic minor limit from permit S-99-061 has been revised. The limit was 18 tpy of VOC increase, since emissions before that project were 6.7 tpy of VOC and the 18 tpy should have been 36 tpy pursuant to 401 KAR 51:017, Prevention of Significant Deterioration of Air Quality (PSD); the Division is changing the limit to 42.7 tpy of VOC.

Synthetic Minor limits from permits S-96-132, C-91-178, C-84-146, and C-84-193 have been evaluated and the Division determined they should not be included in permit V-07-009. In some cases potential emissions are much lower than PSD thresholds, in some other cases the equipment subject to the limit does not exist anymore.

In order to preclude applicability of 401 KAR 59:016, New electric utility steam generating units, and 40 CFR 60 Subpart Da, Standards of Performance for Electric Utility Steam Generating Units for which Construction is Commenced After September 19, 1978 to the Heat Recovery Steam Generators (EP D-3 and D-4), the combined cycle gas turbine shall not supply for sale more than 25 MW electrical output to a utility power distribution system.

In order to preclude the applicability of 40 CFR 61 Subpart F, National Emission Standard for Vinyl Chloride to Airflex Reactor #1 (EP 50), Airflex Reactor #2 (EP 51), Airflex Reactor #4 (EP B-94), Airflex Reactor #5 (EP C-43), and Atmospheric Reactor (EP 48); vinyl chloride monomer shall not be fed to the reactors.

In order to preclude the applicability of 40 CFR 63 Subpart Q, National Emission Standards for Hazardous Air Pollutants for Industrial Process Cooling Towers, the permittee shall not use chromium-based water treatment chemicals in either Cooling Tower #1 (EP M-06), or Cooling Towers #2 and #4 (EP M-07).

**PERIODIC MONITORING:**

Emissions of Vinyl Chloride, which is a HAP, shall be continuously monitored as required by 40 CFR 61 Subpart F, National Emission Standard for Vinyl Chloride. NO<sub>x</sub> and CO shall also be continuously monitored as required by letters from EPA to the source.

In order to satisfy Air Toxics concerns (401 KAR 63:022), permits C-90-084, C-91-178 (Revised), S-96-132 (Revised), require that some emission points comply with the Leak Detection and Repair Program (LDAR) from 40 CFR 60 Subpart VV. These requirements are included in permit V-07-009, except for emission points 52 and F-08 because they have their own LDAR program since they are subject to 40 CFR 61 Subpart F.

**OPERATIONAL FLEXIBILITY:**

NA

**CREDIBLE EVIDENCE:**

This permit contains provisions which require that specific test methods, monitoring or recordkeeping be used as a demonstration of compliance with permit limits. On February 24, 1997, the U.S. EPA promulgated revisions to the following federal regulations: 40 CFR Part 51, Sec. 51.212; 40 CFR Part 52, Sec. 52.12; 40 CFR Part 52, Sec. 52.30; 40 CFR Part 60, Sec. 60.11 and 40 CFR Part 61, Sec. 61.12, that allow the use of credible evidence to establish compliance with applicable requirements. At the issuance of this permit, Kentucky has only adopted the provisions of 40 CFR Part 60, Sec. 60.11 and 40 CFR Part 61, Sec. 61.12 into its air quality regulations.